

RADIO TEST REPORT

FCC ID: 2BGGR-02000SH09

Product : Host of BEYONDFIRE micro fireworks
ignition system

Trade Mark : N/A

Model Name : SH09

Family Model : N/A

Report No. : S24031201302001

Prepared for

HUNAN BEYONDFIRE TECHNOLOGIES CO.,LTD.
No.104,Innovation Venture park A2,YongTai road, Liuyang HI-TECH
Industrial Development Zone,Hunan

Prepared by

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TEST RESULT CERTIFICATION

Applicant's name: HUNAN BEYONDFIRE TECHNOLOGIES CO.,LTD.
Address: No.104,Innovation Venture park A2,YongTai road, Liuyang HI-TECH
Industrial Development Zone,Hunan
Manufacturer's Name.....: HUNAN BEYONDFIRE TECHNOLOGIES CO.,LTD.
Address: No.104,Innovation Venture park A2,YongTai road, Liuyang HI-TECH
Industrial Development Zone,Hunan

Product description

Product name.....: Host of BEYONDFIRE micro fireworks ignition system
Model and/or type reference : SH09
Family Model.....: N/A

Standards: FCC Part15.249

Test procedure ANSI C63.10-2013

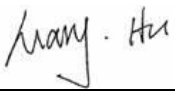
This device described above has been tested by NTEK, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test:

Test Sample number: S240312013002
Date (s) of performance of tests: 12 Mar. 2024 ~ 29 Apr. 2024
Date of Issue.....: 29 Apr. 2024
Test Result.....: **Pass**

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1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15, Subpart C (15.249)			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	N/A	
15.203	Antenna Requirement	Pass	
15.249 15.209	Radiated Spurious Emission	Pass	
15.249(2)	Frequency Tolerance	N/A	
15.249(a)	Fundamental Measurement	Pass	
15.205	Band Edge Emission	Pass	
15.249	Occupied Bandwidth	Pass	

1.1 TEST FACILITY

Shenzhen NTEK Testing Technology Co., Ltd

Add. : 1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang Street, Bao'an District, Shenzhen 518126 P.R. China.

FCC FRN Registration No.:463705; IC Registration No.:9270A-1

CNAS Registration No.:L5516

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	Conducted Emission Test	$\pm 1.38\text{dB}$
2	RF power,conducted	$\pm 0.16\text{dB}$
3	Spurious emissions,conducted	$\pm 0.21\text{dB}$
4	All emissions,radiated(<1G)	$\pm 4.68\text{dB}$
5	All emissions,radiated(>1G)	$\pm 4.89\text{dB}$
6	Temperature	$\pm 0.5^{\circ}\text{C}$
7	Humidity	$\pm 2\%$

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	Host of BEYONDFIRE micro fireworks ignition system	
Trade Mark	N/A	
Model Name	SH09	
Family Model	N/A	
Model Difference	N/A	
Product Description	The EUT is a Host of BEYONDFIRE micro fireworks ignition system	
	Operation Frequency:	2410MHz
	Modulation Type:	GFSK
	Antenna Designation:	Reversed-SMA External Antenna
	Antenna Gain(Peak)	3.5 dBi
	Based on the application, features, or specification exhibited in User's Manual. More details of EUT technical specification, please refer to the User's Manual.	
Channel List	Please refer to the Note 2.	
Rating	DC 9V powered by Battery	
Adapter	N/A	
Battery	DC 9V	
HW Version	N/A	
SW Version	N/A	

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

2.

Channel No.	Frequency
1	2410MHz

3.

Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	N/A	Reversed-SMA External Antenna	N/A	3.5	Antenna

2.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	TX 2410MHz
Mode 2	Normal link

For Radiated Spurious Emission	
Pretest Mode	Description
Mode 1	TX 2410MHz

Note:

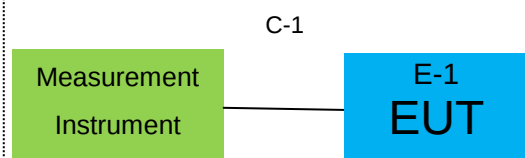
(1) The measurements are performed at the highest, middle, lowest available channels.

2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Spurious Emission Test



For Conducted Test Cases



2.4 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	Host of BEYONDFIRE micro fireworks ignition system	N/A	SH09	N/A	EUT

Item	Cable Type	Shielded Type	Ferrite Core	Length	Note

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.

2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation Test equipment

	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Spectrum Analyzer	Aglient	E4440A	MY41000130	2024.03.12	2025.03.11	1 year
2	Spectrum Analyzer	Agilent	N9020A	MY49100060	2023.05.29	2024.05.28	1 year
3	Spectrum Analyzer	R&S	FSV40	101417	2023.05.29	2024.05.28	1 year
4	Test Receiver	R&S	ESPI7	101318	2023.03.27	2024.04.26	1 year
5	Bilog Antenna	TESEQ	CBL6111D	31216	2024.03.11	2025.03.10	1 year
6	50Ω Coaxial Switch	Anritsu	MP59B	6200983705	2023.05.06	2026.05.05	3 year
7	Horn Antenna	EM	EM-AH-10180	2011071402	2022.03.31	2025.03.30	3 year
8	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	803	2022.11.07	2025.11.06	3 year
9	Amplifier	EMC	EMC051835SE	980246	2023.05.29	2024.05.28	1 year
10	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	055	2023.11.03	2026.11.02	3 year
11	Power Meter	DARE	RPR3006W	15100041SN084	2023.05.29	2024.05.28	1 year
12	Test Cable (9KHz-30MHz)	N/A	R-01	N/A	2022.06.17	2025.06.16	3 year
13	Test Cable (30MHz-1GHz)	N/A	R-02	N/A	2022.06.17	2025.06.16	3 year
14	High Test Cable(1G-40G Hz)	N/A	R-03	N/A	2022.06.17	2025.06.16	3 year
15	High Test Cable(1G-40G Hz)	N/A	R-04	N/A	2022.06.17	2025.06.16	3 year
16	Filter	TRILTHIC	2400MHz	29	2023.03.26	2026.03.25	3 year
17	temporary antenna connector (Note)	NTS	R001	N/A	N/A	N/A	N/A

Note:

We will use the temporary antenna connector (soldered on the PCB board) When conducted test
And this temporary antenna connector is listed within the instrument list

Conduction Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Test Receiver	R&S	ESCI	101160	2024.03.12	2025.03.11	1 year
2	LISN	R&S	ENV216	101313	2024.03.12	2025.03.11	1 year
3	LISN	SCHWARZBECK	NNLK 8129	8129245	2024.03.12	2025.03.11	1 year
4	50Ω Coaxial Switch	ANRITSU CORP	MP59B	6200983704	2023.05.06	2026.05.05	3 year
5	Test Cable (9KHz-30MHz)	N/A	C01	N/A	2023.05.06	2026.05.05	3 year
6	Test Cable (9KHz-30MHz)	N/A	C02	N/A	2023.05.06	2026.05.05	3 year
7	Test Cable (9KHz-30MHz)	N/A	C03	N/A	2023.05.06	2026.05.05	3 year

Note: Each piece of equipment is scheduled for calibration once a year except the Test Cable which is scheduled for calibration every 3 years.

3. ANTENNA REQUIREMENT

3.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

3.2 EUT ANTENNA

The EUT antenna is permanent attached Reversed-SMA External Antenna (Gain:3.5dBi). It comply with the standard requirement.

3.3 CONDUCTED EMISSION MEASUREMENT

3.3.1 POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)

Frequency(MHz)	Conducted Emission Limit	
	Quasi-peak	Average
0.15-0.5	66-56*	56-46*
0.5-5.0	56	46
5.0-30.0	60	50

Note: 1. *Decreases with the logarithm of the frequency
2. The lower limit shall apply at the transition frequencies
3. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

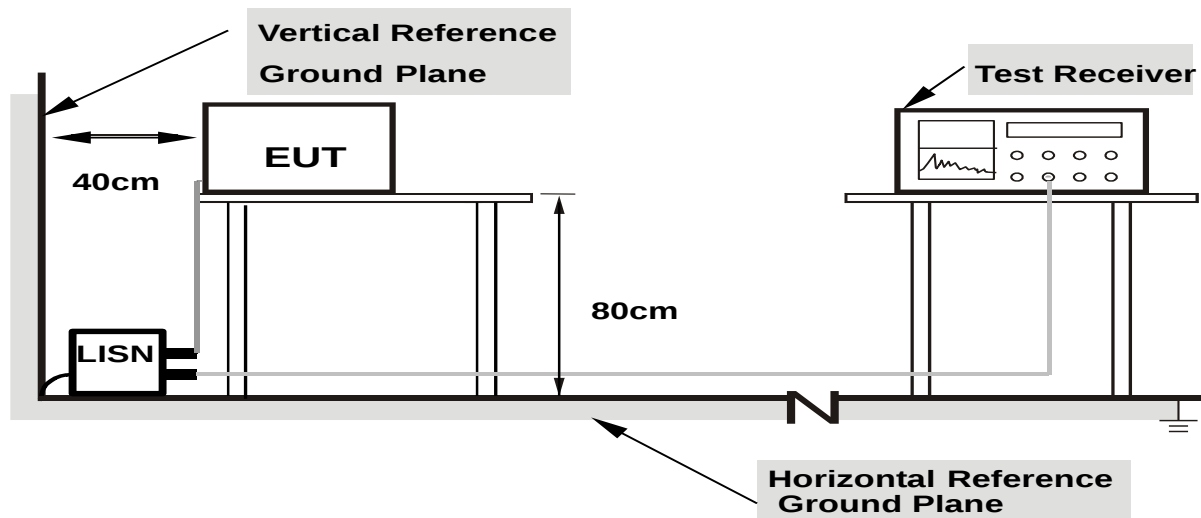
3.3.2 TEST PROCEDURE

- The EUT was placed 0.4 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- LISN at least 80 cm from nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.
Margin=Measure-ment-Limits, Measure-ment=Reading level+Correct Factor

3.3.3 DEVIATION FROM TEST STANDARD

No deviation

3.3.4 TEST SETUP



Note: 1.Support units were connected to second LISN.
 2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.2.5 TEST RESULT

EUT :	Host of BEYONDFIRE micro fireworks ignition system	Model Name :	SH09
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N/A
Test Voltage :	N/A	Test Mode :	N/A

Note: Not Applicable

3.4 RADIATED EMISSION MEASUREMENT

3.4.1 Radiated Emission Limits (FCC 15.209)

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
Frequency (MHz)	Limit (dBuV)	
30~88	40	3
88~216	43.5	3
216~960	46	3
960 -10000	54.00	3
*902 - 928	94.00	3

Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission level (dBuV/m)=20log Emission level (uV/m).
- (3) *Note: This is the limit for the fundamental frequency.

LIMITS OF RADIATED EMISSION MEASUREMENT (FCC 15.249)

Frequency of Emission (MHz)	Field Strength of fundamental ((millivolts /meter)	Field Strength of Harmonics (microvolts/meter)
2400-2483.5	50	500

Notes:

- (1) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1MHz / 1MHz for Peak

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

3.4.2 TEST PROCEDURE

- a. The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- b. The EUT was placed on the top of a rotating table 0.8 m for below 1GHz and 1.5m for above 1GHz the ground at a 3 meter. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment or of the substitution antenna shall be 0.8 m for below 1GHz and 1.5m for above 1GHz; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

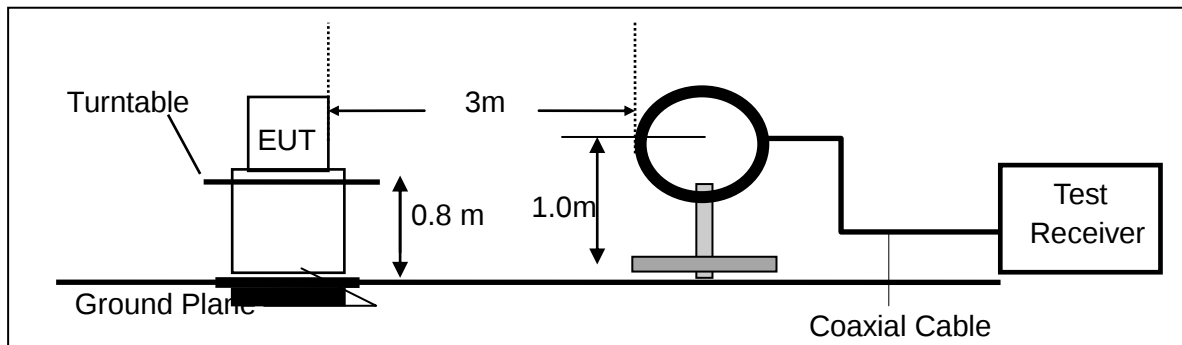
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

3.4.3 DEVIATION FROM TEST STANDARD

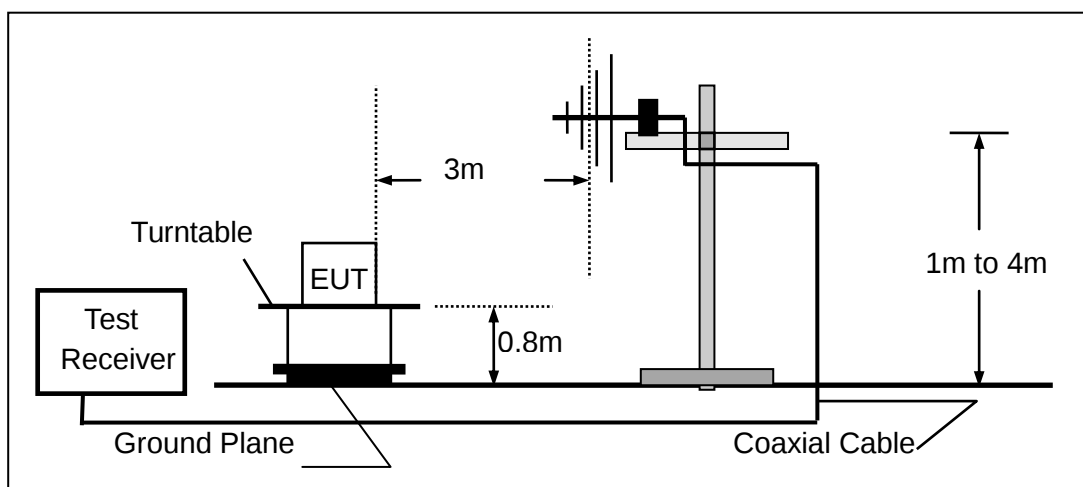
No deviation

(A) Radiated Emission Test-Up Frequency Below 30MHz

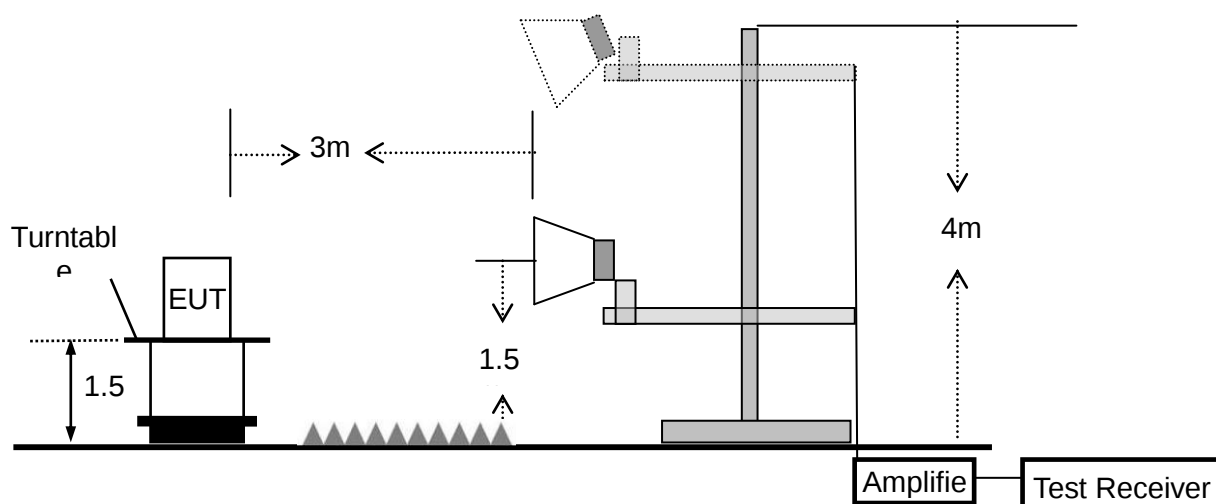
(a)



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



3.4.4 TEST RESULTS (BELOW 30MHz)

EUT :	Host of BEYONDFIRE micro fireworks ignition system	Model Name. :	SH09
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 9V
Test Mode :	TX	Polarization :	--

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	PASS
--	--	--	--	PASS

NOTE:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Remark:1. Emission level in dBuV/m=20 log (uV/m)

2. Measurement was performed at an antenna to the closed point of EUT distance of meters.

3. For Frequency 9kHz~30MHz:

Distance extrapolation factor =40log(Specific distance/ test distance)(dB);

Limit line=Specific limits(dBuV) + distance extrapolation factor.

For Frequency above 30MHz:

Distance extrapolation factor =20log(Specific distance/ test distance)(dB);

Limit line=Specific limits(dBuV) + distance extrapolation factor.

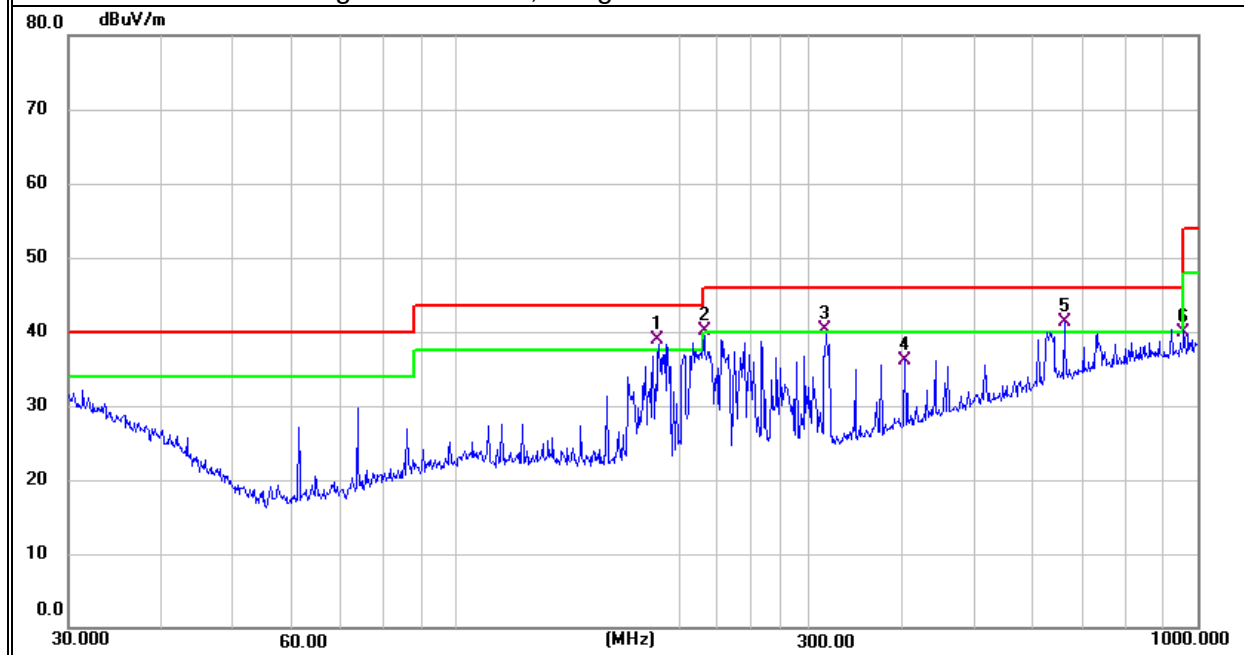
3.4.5 TEST RESULTS (BELOW 1000 MHz)

EUT :	Host of BEYONDFIRE micro fireworks ignition system	Model Name :	SH09
Temperature :	25 °C	Relative Humidity :	51%
Pressure :	1010 hPa	Test Voltage :	DC 9V
Test Mode :	Mode 1	Polarization :	Vertical

Polar (H/V)	Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Remark
	(MHz)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
V	187.7529	22.53	16.37	38.90	43.50	-4.60	QP
V	216.0240	23.32	16.69	40.01	46.00	-5.99	QP
V	315.4806	19.93	20.37	40.30	46.00	-5.70	QP
V	403.2500	12.93	23.27	36.20	46.00	-9.80	QP
V	661.1503	13.99	27.41	41.40	46.00	-4.60	QP
V	958.7943	8.60	31.29	39.89	46.00	-6.11	QP

Remark:

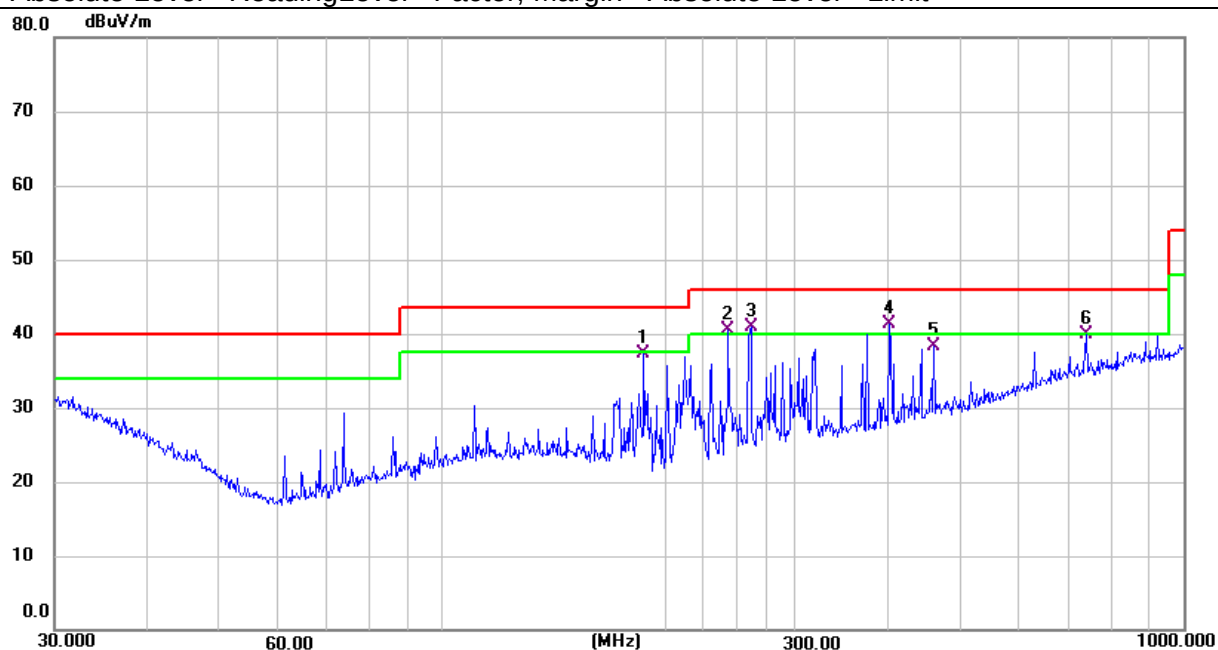
Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level - Limit



Polar (H/V)	Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Remark
	(MHz)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
H	187.0954	20.99	16.40	37.39	43.50	-6.11	QP
H	243.3771	22.29	18.21	40.50	46.00	-5.50	QP
H	261.0581	21.62	19.38	41.00	46.00	-5.00	QP
H	401.8383	18.15	23.25	41.40	46.00	-4.60	QP
H	460.7271	14.02	24.31	38.33	46.00	-7.67	QP
H	739.6603	11.30	28.68	39.98	46.00	-6.02	QP

Remark:

Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level - Limit



3.4.6 TEST RESULTS (ABOVE 1000 MHZ)

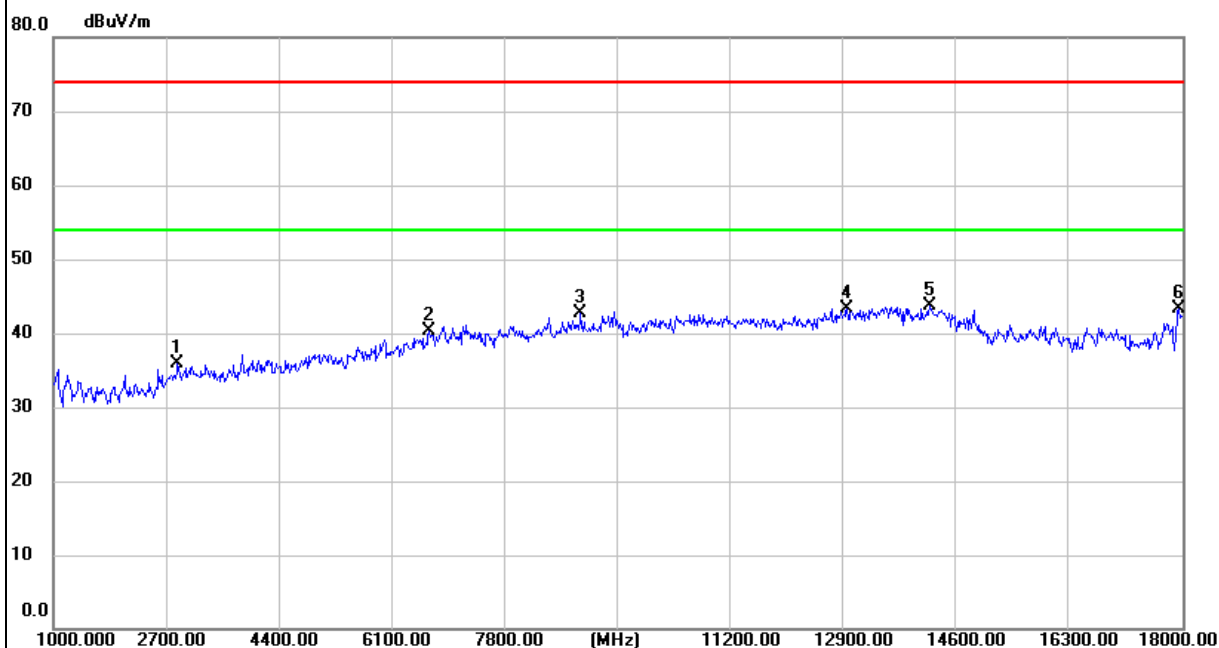
Note: For above 18GHz, the amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

EUT :	Host of BEYONDFIRE micro fireworks ignition system	Model Name :	SH09
Temperature :	25 °C	Relative Humidity :	51%
Pressure :	1010 hPa	Test Voltage :	DC 9V
Test Mode :	TX 2410MHz	Polarization :	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2870.000	52.49	-16.53	35.96	74.00	-38.04	peak
6661.000	49.85	-9.61	40.24	74.00	-33.76	peak
8939.000	48.49	-5.85	42.64	74.00	-31.36	peak
12951.000	44.58	-1.20	43.38	74.00	-30.62	peak
14192.000	44.58	-0.93	43.65	74.00	-30.35	peak
17949.000	39.14	4.11	43.25	74.00	-30.75	peak
2870.000	52.49	-16.53	35.96	74.00	-38.04	peak

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.



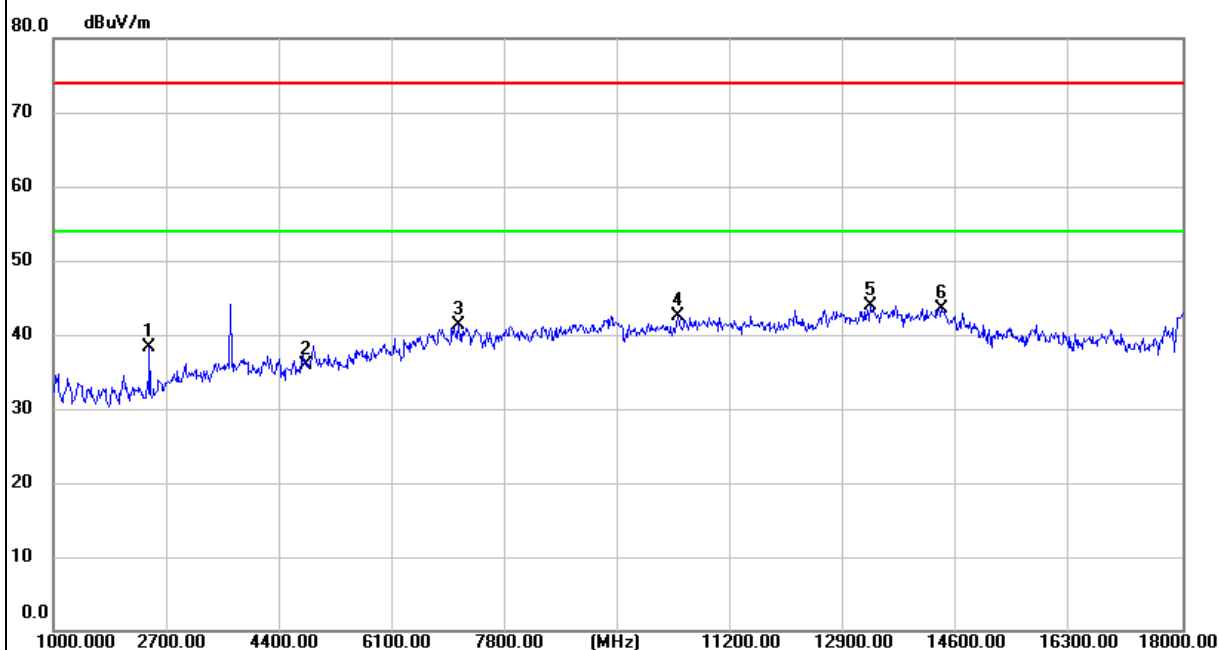
EUT :	Host of BEYONDFIRE micro fireworks ignition system	Model Name :	SH09
Temperature :	25 °C	Relative Humidity :	51%
Pressure :	1010 hPa	Test Voltage :	DC 9V
Test Mode :	TX 2410MHz	Polarization :	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2445.000	56.77	-18.47	38.30	74.00	-35.70	peak
4810.000	49.47	-13.48	35.99	74.00	-38.01	peak
7103.000	49.88	-8.66	41.22	74.00	-32.78	peak
10401.000	46.73	-4.14	42.59	74.00	-31.41	peak
13308.000	44.91	-1.06	43.85	74.00	-30.15	peak
14379.000	44.51	-0.96	43.55	74.00	-30.45	peak

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No emission above 18GHz.



Note: EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report(X orientation).

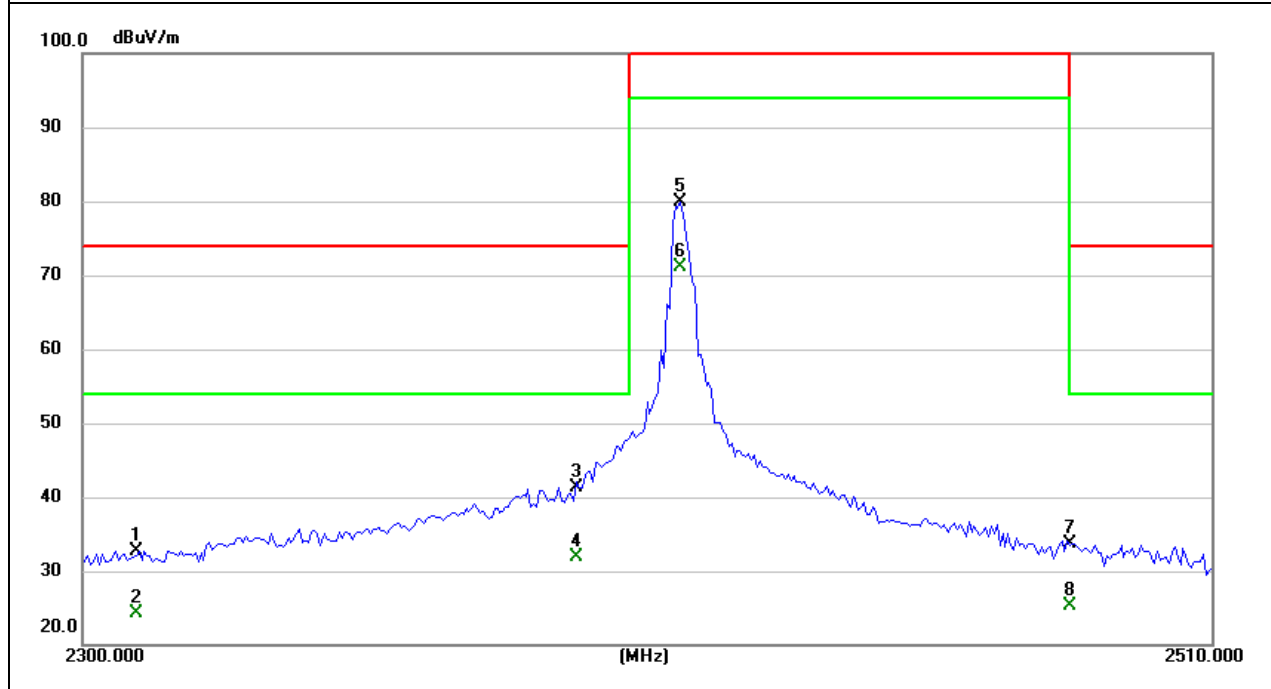
3.4.7 TEST RESULTS (RESTRICTED BANDS REQUIREMENTS)

EUT :	Host of BEYONDFIRE micro fireworks ignition system	Model Name :	SH09
Temperature :	25 °C	Relative Humidity :	51%
Pressure :	1010 hPa	Test Voltage :	DC 9V
Test Mode :	TX 2410MHz	Polarization :	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310.000	37.10	-4.39	32.71	74.00	-41.29	peak
2310.000	28.68	-4.39	24.29	54.00	-29.71	AVG
2390.000	45.93	-4.57	41.36	74.00	-32.64	peak
2390.000	36.46	-4.57	31.89	54.00	-22.11	AVG
2410.000	84.41	-4.55	79.86	114.00	-34.14	peak
2410.000	75.68	-4.55	71.13	94.00	-22.87	AVG
2483.500	38.03	-4.27	33.76	74.00	-40.24	peak
2483.500	29.63	-4.27	25.36	54.00	-28.64	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

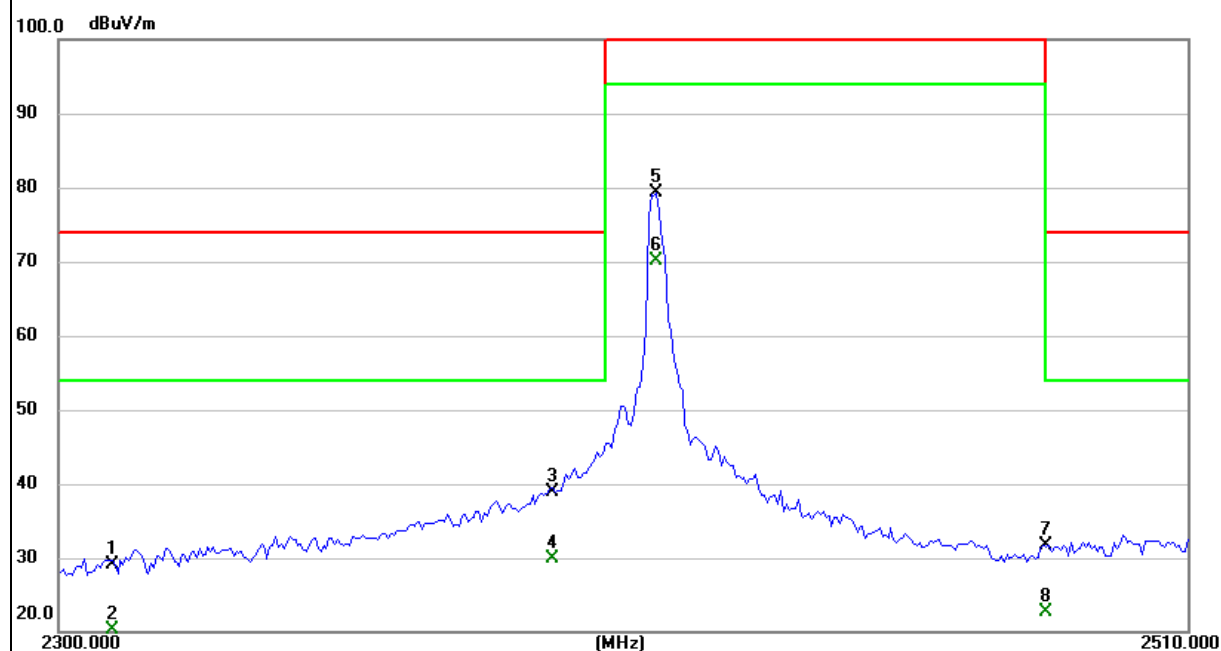


EUT :	Host of BEYONDFIRE micro fireworks ignition system	Model Name :	SH09
Temperature :	25 °C	Relative Humidity :	51%
Pressure :	1010 hPa	Test Voltage :	DC 9V
Test Mode :	TX 2410MHz	Polarization :	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310.000	33.59	-4.39	29.20	74.00	-44.80	peak
2310.000	24.68	-4.39	20.29	54.00	-33.71	AVG
2390.000	43.53	-4.57	38.96	74.00	-35.04	peak
2390.000	34.57	-4.57	30.00	54.00	-24.00	AVG
2410.000	83.87	-4.55	79.32	114.00	-34.68	peak
2410.000	74.68	-4.55	70.13	94.00	-23.87	AVG
2480.000	35.98	-4.27	31.71	74.00	-42.29	peak
2480.000	26.87	-4.27	22.60	54.00	-31.40	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.



4. BANDWIDTH TEST

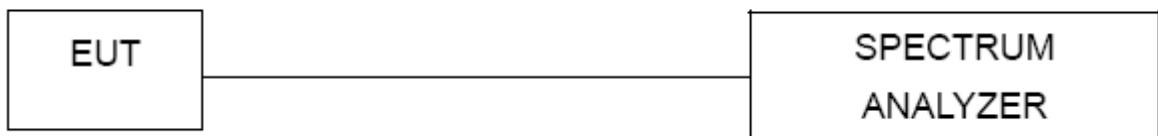
4.1 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting : RBW= 100KHz, VBW $\geq$ RBW, Sweep time = Auto.

4.2 DEVIATION FROM STANDARD

No deviation.

4.3 TEST SETUP

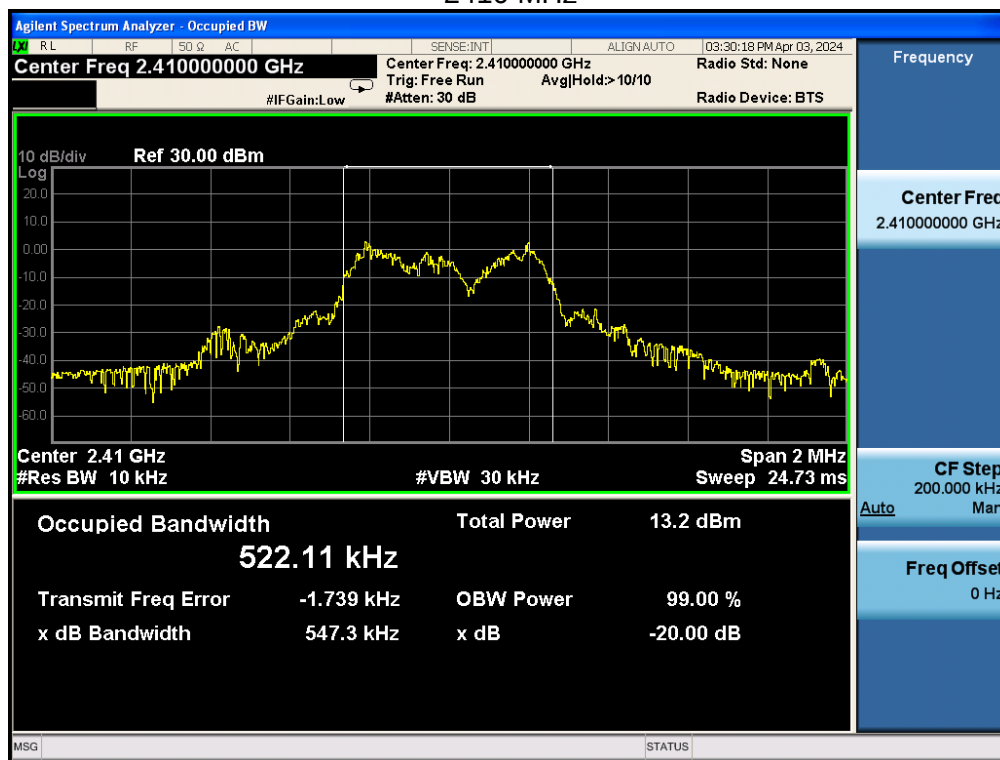


5. TEST RESULTS

EUT :	Host of BEYONDFIRE micro fireworks ignition system	Model Name :	SH09
Temperature :	26 °C	Relative Humidity :	53%
Pressure :	1020 hPa	Test Power :	DC 9V
Test Mode :	TX(2410MHz)		

Test Frequency (MHz)	20 dBc Bandwidth (kHz)
2410	547.3

2410 MHz



END OF REPORT